THE GENESIS AND TECTONIC SIGNIFICANCE OF CHROMITITE-BEARING SERPENTINITES IN SOUTHERN NSW

Thesis submitted as a requirement of the Doctor of Philosophy degree,
University of Technology, Sydney
New South Wales, Australia

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1998

"I declare that the work presented in this thesis is the result of original research by the author"

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ACKNOWLEDGEMENTS

Many people have provided help during the duration of this project and this is hereby acknowledged.

I would like to thank my co-supervisors, Adjunct Professors Brenda J. Franklin and Brian Marshall for the initiation of this project, their enthusiastic encouragement and support throughout its duration, and their numerous comments on the manuscript. They are also thanked for receiving the various grants, which were necessary to fund this research, and also, for undertaking all of the administrative work associated with these grants.

Professor Evan Leitch of the Geology Department is thanked for his comments on the manuscript, and especially, for his advice and comments on tectonics. Leighonie Hunt of the Geology Department is much appreciated for her help with the drafting of figures and tables, and most useful advice on working with Microsoft Word and Microsoft Excel.

Alan Giles of the Geology Department is thanked for his help with the production of thin-sections and polished mounts, advice on fluid inclusions, and for being a good mate. Rod Hungerford of the Geology Department is thanked for his help with the collection of samples for geochronological investigations, advice on beer, and particularly for being a good mate. Alan Buttenshaw of the Geology Department helped with computer problems and is also thanked for letting me use his laser printer. Dr Edgar Frankel of the Geology Department is very much thanked for his support and encouragement throughout the duration of this project. Dr Graziella Caprarelli of the Geology Department is thanked for her advice and comments on the Nd-Sm isotope results.

David Colchester is thanked for sharing his great practical knowledge on XRD analysis and mineralogy. Maree Anast is thanked for her advice and help with XRD analysis. Mathew Phillips and Ric Wuhrer of the Microanalysis Unit of the Faculty of Science are thanked for their advice and guidance on Scanning Electron Microscopy.

Jeff Davis from the CSIRO Division of Exploration and Mining, North Ryde is thanked for his advice and help with sample preparation and zircon grain separation. Dr John McAndrew is thanked for his advice on the mineralogy, chemistry and analysis of chromitites. Helen Waldron and Brian Garnett of Becquerel Laboratories, Lucas Heights, are thanked for their advice on Neutron Activation Analysis. Mark Fanning of the RSES, ANU, is thanked for his advice on the age-dating of the plagiogranites. Helena Basden from the Geological Survey of NSW is very much thanked for sharing her vast knowledge of the Tumut region.

Paul Jones, Dieter Bruggermann, Somaly Srey, Piers Reynolds, James Wilson, Robert Parker, Paul Cheadle and Jane Giddey, all former undergraduate students within the Geology Department of UTS, are very much thanked for their help and companionship in the field.

My sister, Tina Graham, is thanked for her help with photocopying and advice on Microsoft Word and Microsoft Excel, while my brother Paul is thanked for lending me the money when it was needed.

My friends, Andrew, Julie, Paul, Barbara, Dion, Doug, Ross, Tony, Terry and David are thanked for providing distractions when I needed a break. Scott and Martin are thanked for the distracting and competitive golf. My niece, Breannan, and nephew, Conor are also thanked for distracting me during their visits.

Funding was provided by an Australian Postgraduate Research Award. Work on the podiform chromitites was funded by a joint CSIRO/UTS co-operative research grant. The neutron activation analyses were funded by grants from ANSTO while, funding for the geochronological investigations was provided by an internal UTS research grant. Financial support for attending conferences in Australia and overseas was provided by grants from the UTS Vice-Chancellors postgraduate student conference fund, the Geology Department at UTS, and the NSW Division of the Geological Society of Australia.

Finally, most of all I would like to thank my parents, Paul and Hilary Graham, for their continual support and encouragement throughout my life, especially in times of hardship.

ABSTRACT

The Tumut Serpentinite Province consists of four major serpentinite belts and numerous small serpentinite bodies, that occupy a long narrow tract within the Lachlan Fold Belt of southern NSW. The tectonic setting of one belt, the Coolac Serpentinite Belt, has been contentious. Much of the uncertainty results from lack of a combined study on the major belts and inadequate age constraints. Resolving the uncertainty will benefit construction of a tectonic model for the evolution of the Lachlan Fold Belt.

The belts mainly comprise massive serpentinite or harzburgite, with internal shear zones of schistose serpentinite, and intrusions of plagiogranite, gabbro, basalt, pyroxenite, dunite and chromitite. The main foliation has a consistent NNW-SSE trend and is similar in the adjacent rock units. The various rock types of the serpentinite belts are geochemically akin to similar rocks from ophiolite sequences.

Podiform chromitites are geochemically, mineralogically and geometrically akin to those in the mantle sequence of most ophiolites. The different chromitite types are interpreted in terms of the degree of evolution of the MORB-type magma and hence the extent of fractionation of the source. Serpentinisation and rodingitisation occurred during progressive cooling of the chromitites and host rocks and were accompanied by systematic fracturing and remobilisation of chemical components.

Radioisotope dating gives an age of crystallisation of 412-400 Ma for the plagiogranites and leucogabbros, whilst an inherited zircon age of 430 Ma appears to be derived from Early Silurian felsic volcanic rocks of the region. As the plagiogranites, leucogabbros and other rock types within the serpentinite belts have common deformational and metamorphic histories, their crystallisation age constrains the ages of deformation and metamorphism.

The serpentinite belts are interpreted as ophiolites of the 'embryonic' type that formed within a back-arc basin setting in the Late Silurian-Early Devonian. Crystallisation of the MORB sequence and emplacement onto continental crust, together with metamorphism and deformation may have only spanned 20 Ma. In the Late Silurian to Early Devonian, the Tumut Serpentinite Province

differed from basins elsewhere within the Lachlan Fold Belt in that a volcanic arc was ruptured by mantle-derived MORB magmas which ascended to the surface. Their extrusion was short-lived and after the Early Devonian, the development of the Tumut region differed little from that in the rest of the Lachlan Fold Belt.

The development of oceanic crust within the Tumut Serpentinite Province and the generation of granitic magmas within the central and eastern parts of the Lachlan Fold Belt are symptomatic of the same Late Silurian to Early Devonian tectonothermal event. An important aspect of this is that oceanic and crustal rocks need not form from different events or in substantially different tectonic settings.

TABLE OF CONTENTS

LIST OF PLATES

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES